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TEST SUPPORT TO BMDO SYSTEM AND TECHNOLOGY PROGRAMS

MISSLE DEFENSE SESSION
AIAA MISSILE SCIENCES CONFERENCE

Patrick T. Clancy
Deputy Director, Test Resources
Ballistic Missile Defense Organization

7-9 November 2000

As a way of introducing the "TEST" context of this session, this brief will describe how the BMDO T&E Program is structured and how the Test Infrastructure which includes Targets, Ground Test Facilities (GTFs), Ranges and Air borne Sensors is designed to support BMDO MDAP and Technology Program Test Requirements. The majority of our speakers today have used the BMDO GTFs or Test Ranges to conduct the programs they are reporting on.

Agenda

Today's Briefing will address…

- **BMDO Organization and Management**
- **BMDO Corporate Test Program**
- **T&E Ranges, Instrumentation, and Facilities**
  - **BMDO Ground Test Facilities**
  - **BMDO Test Ranges and Launch Facilities**
  - **BMDO Ground Test Facilities**
  - **BMDO Auxiliary Assets**
- **Future Test Support Considerations and Issues**

This chart depicts the BMDO organization as of 1 September 2000. The T&E program is led by the Deputy for Test, Simulation and Evaluation, Dr. Patricia Sanders. Her organization works closely with the Chief Architect, Deputy for System Engineering, and the Deputy for Acquisition, Strategy and Long-Range Planning to organize and conduct the Corporate Test Program. The T&E program also supports the BMDO Technology Programs under the Chief Scientist

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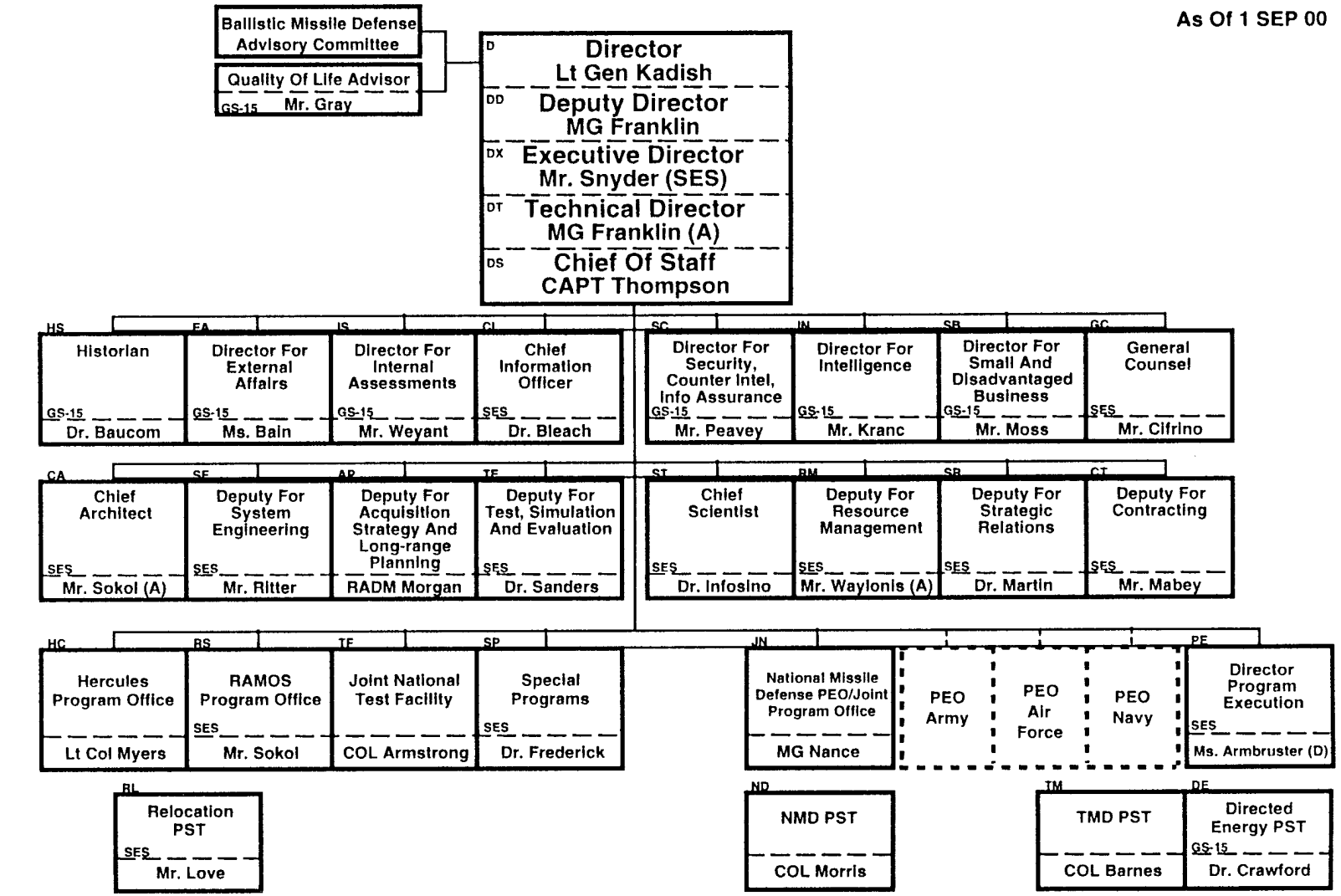
BMDO Reorganization

BMDO/TER

As Of 1 SEP 00



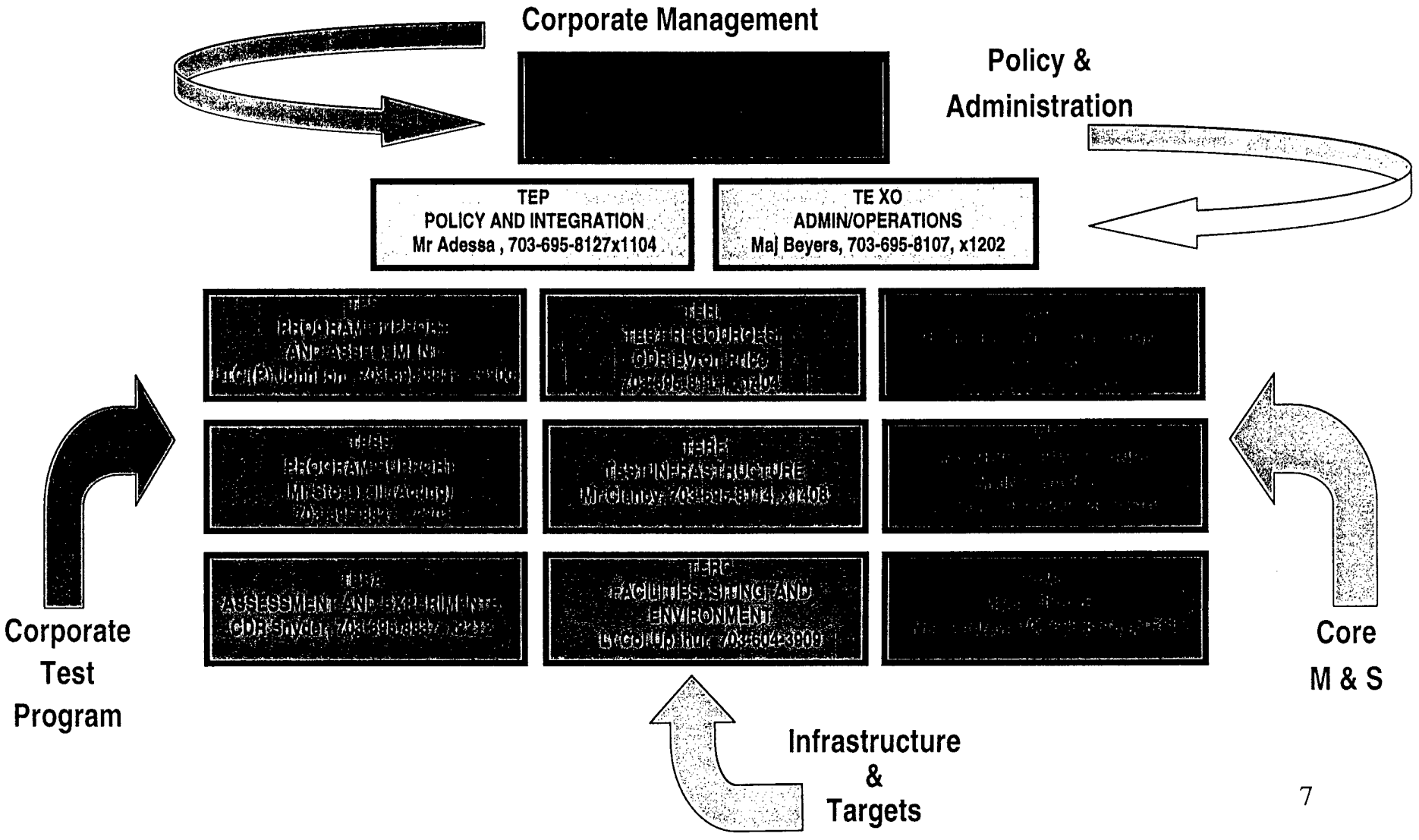
mj-99572C / 082500

This chart shows the four major focus areas within TE. Each area is the purview of a Directorate. All must work together to execute the required BMDO Test Program.

Until Recently, I was the Acting Director of TER. Now that Commander Price has joined us, I am serving as the Deputy Director with overall control over the Test Infrastructure

TE Corporate Management

BMDO/TER



This chart shows the major Corporate T&E Program Objectives. Technology development and insertion insures the future performance of the T&E FoS; evaluating the performance of the individual systems, as well as the interoperability between systems is necessary to make deployment decisions.

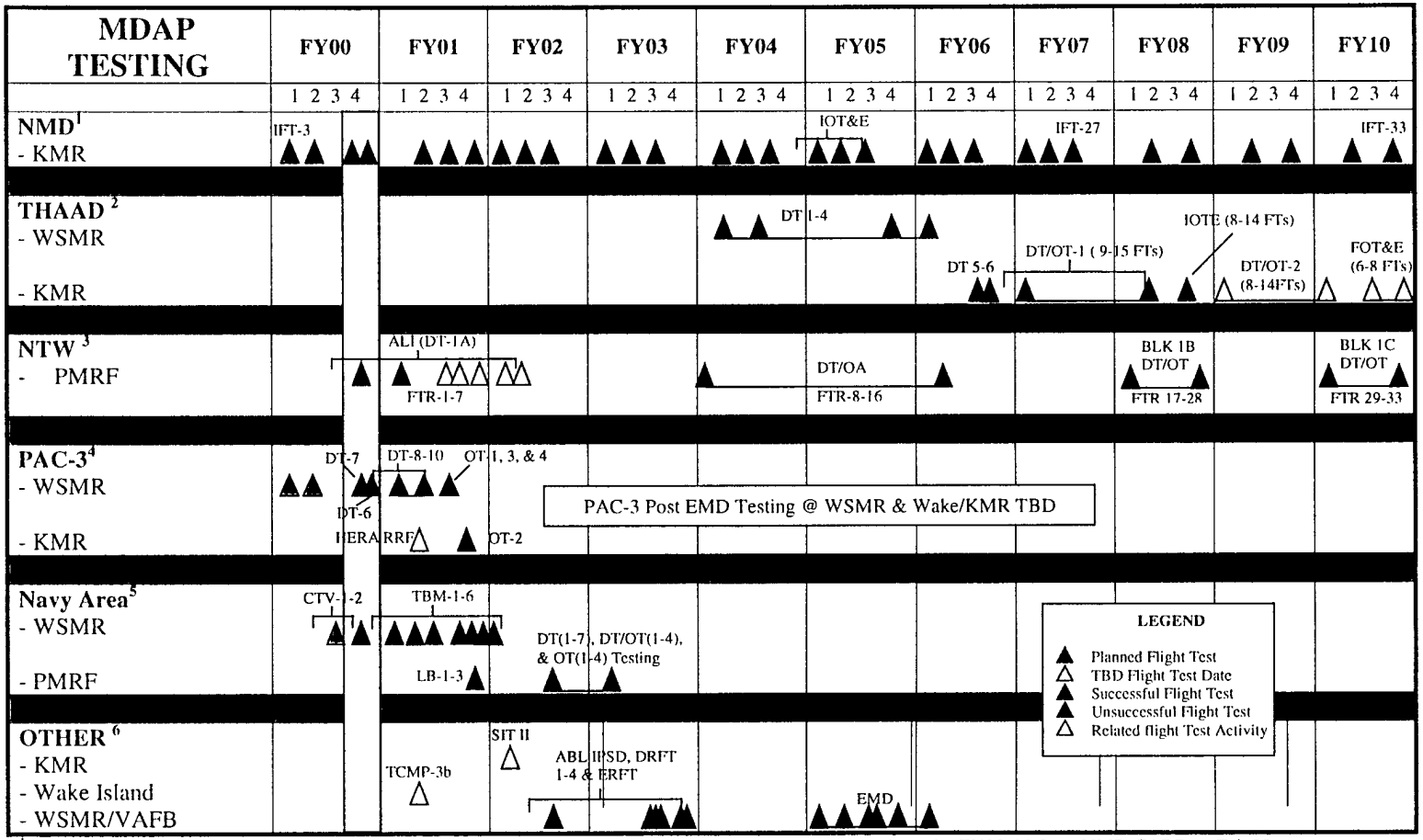
Corporate T&E Program Objectives

- Support Technology Development.
- Support of Technology Insertion for Evolutionary Acquisition in Spiral Development.
- Support of Systems Engineering for Interoperability and Other Family of Systems (FoS) Capabilities
- Characterization, Demonstration and Verification of Achievement of FoS Capabilities to Include Interoperability.
- Collection of Other Necessary Test Data, That Is Not Exclusively the Responsibility of an Individual MDAP

This schedule shows which programs will be tested -- where and when.
The schedule, although always in flux, none-the-less can be used as a basis to plan corporate target development programs, necessary range and GTF improvements, and sensor support

MDAP T&E Execution

BMDO/TER



[1] Data for FY00 provided from NMD JPO Calendar 22 June 00. FY01-07 from NMD SE IPT 18 Apr 00. Data for FY08-10 from NMD CARD as Feb 00.

[2] Data from the THAAD TEMP (Revision D) 22 Mar 00 & TTPC by SMDC for 26 June 00.

[3] Data for FY00 provided by NTW Action Officer (AO) Meeting 31 May 00. FY01-10 from NTW CARD (Rev 2.0) 14 April 00 & Integration IPT 12 May 00.

[4] Data for FY00 provided by PAC-3 AO Meeting 1 June 00. FY01 from Patriot Program Office (PPO) 31 May 00.

[5] Data from the Navy Area TEMP April 00 (Classified) & TTPC by SMDC for 26 June 00.

[6] TCMP-3b Data from the TTPC produced by SMDC for 10 May 00. Notional SIT II data provided by FoS. ABL data from SMDC 26 June 00.

Rev 7.2

This chart shows some of the key integration test events that are part of the overall Corporate Test Program.

TCMP, SIT, and the Space Technology Research Vehicle were flight tests, the other tests involve modeling and simulation to include operators in the loop in the Joint Service Exercises. The chart also shows the BMDO Program focus for each test.

Corporate Test Program Overview

BMDO/TER

Data Collection Events	FY00	FY01	FY02	BMDO Programs							
				Phenomenology	Lethality	Project Hercules	Technology Development	System Engineering	Interoperability	CINC Assessments	M&S
Hardware-in-the-Loop Tests (HWILT)	▲ 00a	▲ 01a ▲ 01b	▲ 02a ▲ 02b					●	●		●
TMD Critical Measurements Program (TCMP)	▲ 3a	▲ 3b		●		●		●	●		●
System Integration Test (SIT) II/Overlays			▲	●		●		●	●		●
Transport Response Experiment (TREx)	▲ Phase 1	▲ Phase 2			●		●				
Space Technology Research Vehicle	▲					●	●	●			
TAMDI ACTD	▲								●		
Wargames	JTBMD ▲—▲	▲ NMD BMC3						●			
Joint Service Exercises	JP V ▲ RS	▲ FE ▲ RS ▲ ASCIET	▲ FE ▲ RS						●	●	

This chart depicts BMDO's primary HWIL facility - the JNTF.

The HWILT exercises focus on FoS interoperability assessments using a distributed, real-time data architecture.

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Hardware-In-The-Loop Using TMDSE Tool

BMDO/TER

THEATER MISSILE DEFENSE SYSTEMS EXERCISER (TMDSE) IS...

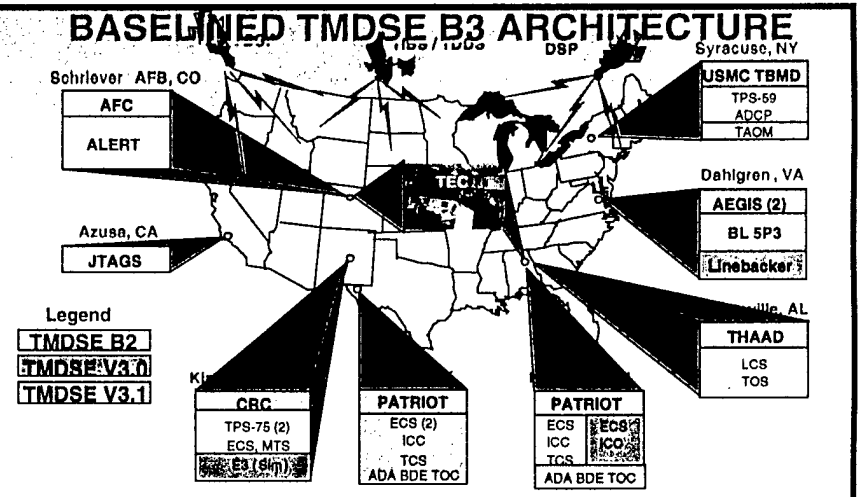
... A Computer Based
Hardware-in-the Loop (HWIL)
Developmental Test Tool

... For Interoperability Assessment

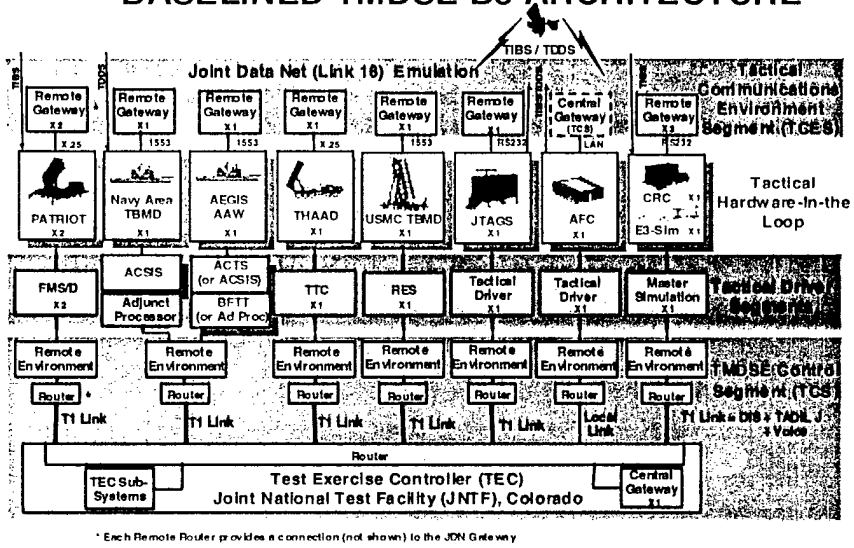
Sensors
Tactical Processors
BM/C3

Real Time, Dynamic, Interactive
Centrally Controlled From JNTF
Geographically Distributed Architecture

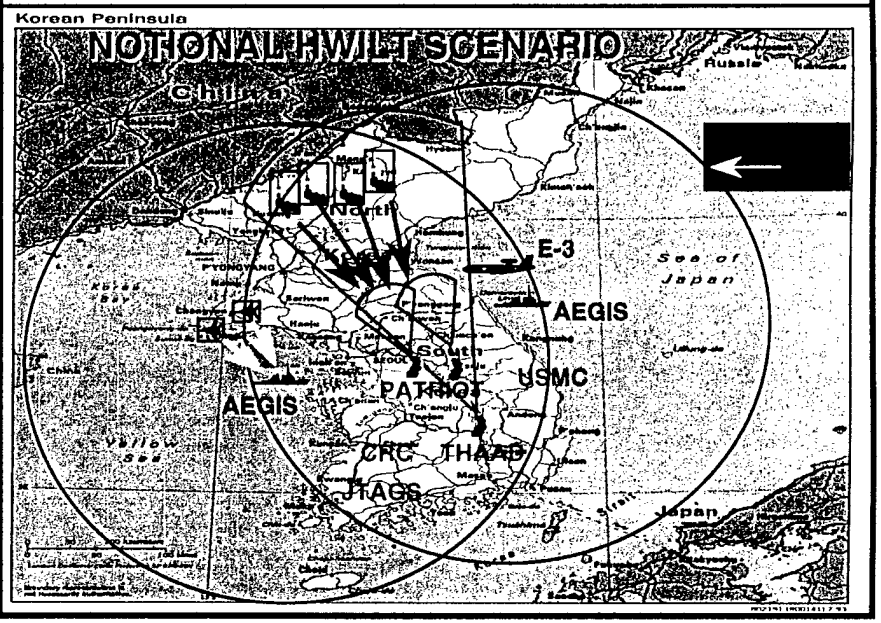
BASELINED TMDSE B3 ARCHITECTURE



BASELINED TMDSE B3 ARCHITECTURE



* Each Remote Router provides a connection (not shown) to the JDN Gateway



SIT II will be a major interoperability exercise, testing the ability of the MDAPs to work together during live fire tests.

The plan is to have four target flights, with three form Wake Island.. There will be two planned intercepts (Patriot and Navy Area).

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System Integration Test II (SIT-II)

BMDO/TER

Location / Time Frame / Scenario

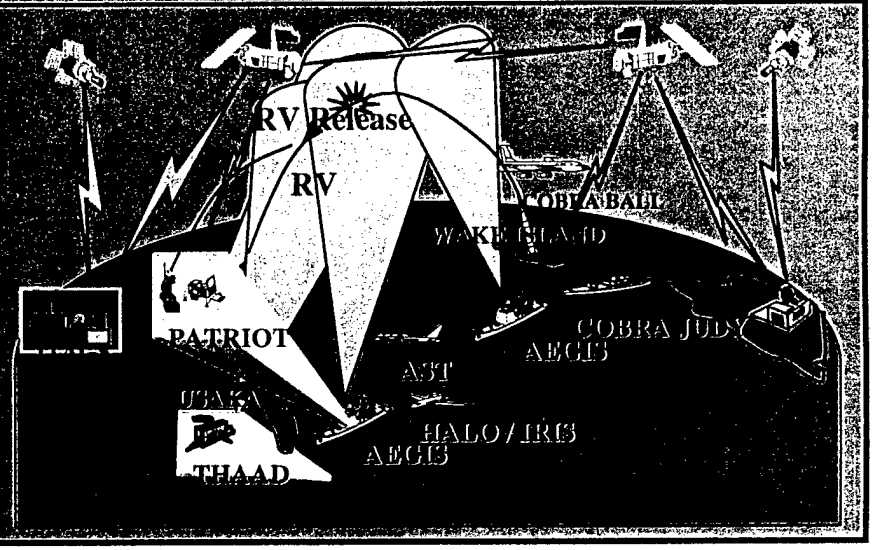
- 1QFY02
- Kwajalein Missile Range
- 4-6 Week Duration
- Multiple TBM Scenarios
- Threat Representative Targets
- Intercepts

BMDO Objectives

- Interoperability Assessment
- Model and Simulation Validation Data
- IMPACT 98 Lower Tier System Demonstration
- Target Characterization

Core Participants

- PATRIOT PAC-3
- Navy Area TBMD
- Navy Theater Wide
- THAAD
- Theater Event System (TES)



TCMP is both a BMC3 interoperability and countermeasures test. The forward sensors gather target /object data and the relay the target data to the other participants via JTTDS, Link 16.

The live target data will later be used to validate threat models and discrimination algorithms.

The TCMP target consists of the aero-booster - SR-19 (2 stacks) -and a threat representative RVand countermeasures suite launching from Wake into KMR

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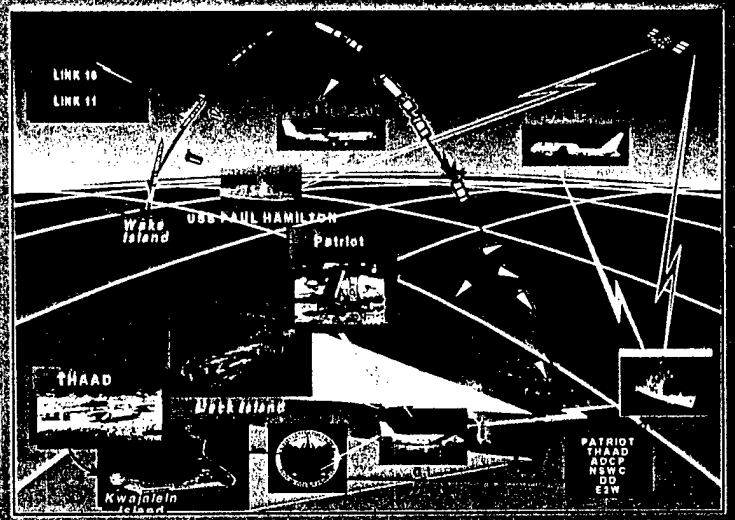
TMD Critical Measurements Program

BMDO/TER



Program Purpose

Reduce Theater Missile Defense System Risks Through:

- Threat Missile Emulation
  - Signature
  - Payloads
- Collect Intercept Data
  - Accurate
  - Potential
- Complex Stressing Target Scenes
- Comprehensive Radar & Optical Data Collection

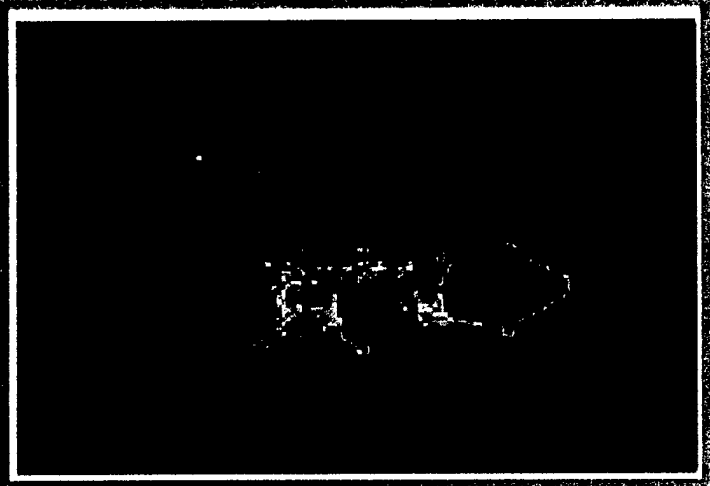
TCMP Objectives

TCMP-3B

- Provide a Common Data Collection Opportunity on a Threat Representative Medium Range Ballistic Missile
- IMPACT 98
- Booster Segmentation and Liquid Fuel Dump Experiment

TCMP-4

- Provide a Common Data Collection Opportunity on a Threat Representative Short Range Ballistic Missile
- Test Current and Currently Updated Version of the Threat
- Off-Nominal Threat Scenario With Separating RV Event



TCMP-2B FASP Image

Before you can execute a Corporate Test Program, however, you need to plan for and fund the "test infrastructure." This is the Program that my Directorate within BMDO/TE is responsible for. It consists of ground test facilities, ranges and sensors, and targets. Collectively it is approximately a $150M/year program or about 3-4% of the overall BMDO budget

BMDO Test Infrastructure

- Ground Test Facilities
- Ranges
- Mobile Sensors
- Targets

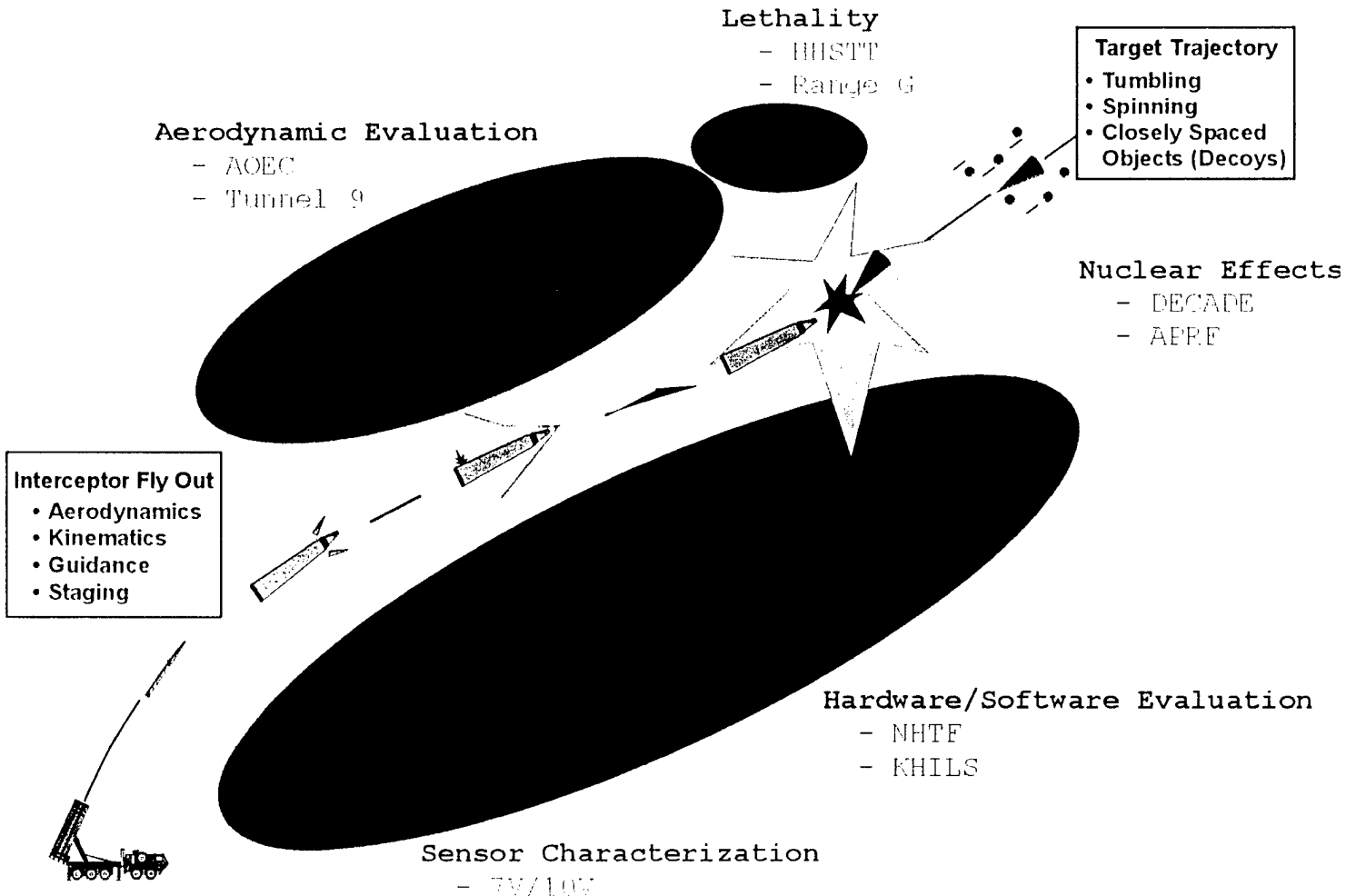
Before you can go to the range and conduct live flight testing as in SIT II and TCMP, a lot of interceptor developmental testing must be accomplished in the BMDO supported ground test facilities.

This chart shows the five main categories of ground testing: Nuclear Weapons Effects, Lethality, Aerodynamic Evaluation, Hardware/Software Evaluation and Sensor Characterization.

The chart also shows what kind of testing needs to be done at each stage in an interceptors flight and the BMDO supported test facilities that do the tests.

GTF Test Focus Areas

BMDO/TER



This chart shows the geographic locations of the BMDO sponsored ground test facilities, all located within the contiguous United States

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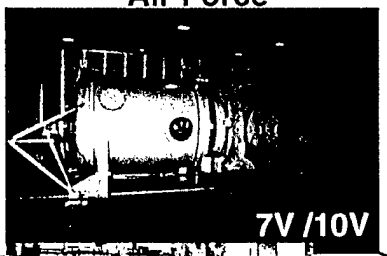
BMDO Funded Ground Test Facilities

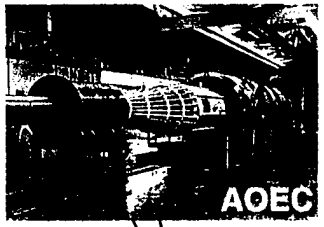
BMDO/TER

Tullahoma, TN
Air Force

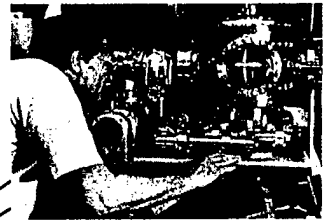


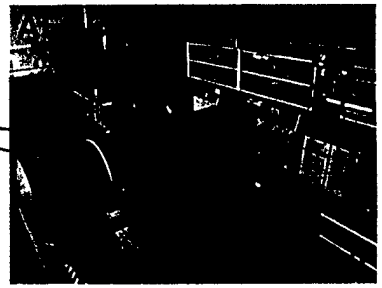
AEDC

Buffalo, NY
Army

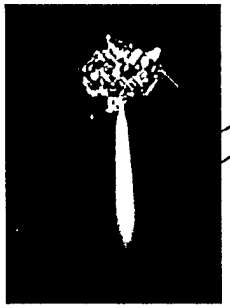


Gaithersburg, MD
Air Force



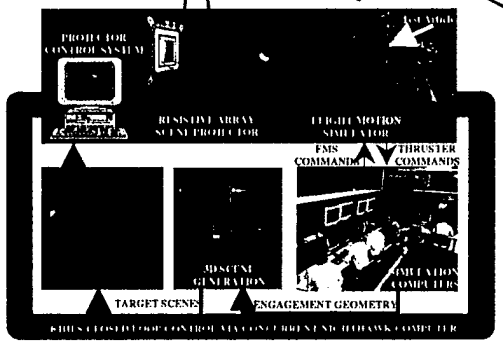


White Oak, MD
Air Force



Edwards AFB, CA
Air Force

Holloman AFB, NM
Air Force



Eglin AFB, FL
Air Force

Huntsville, AL
Army

The developmental programs also use some ground test facilities that are not currently funded by BMDO

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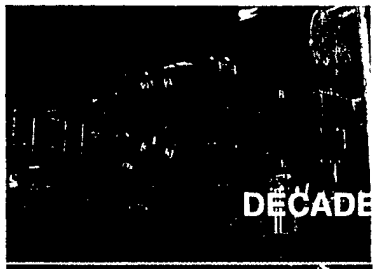
Other Ground Test Facilities Used By BMDO

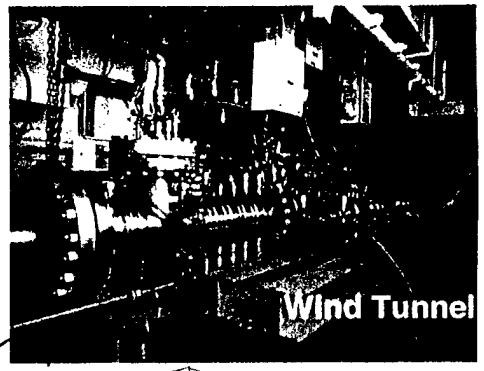
BMDO/TER

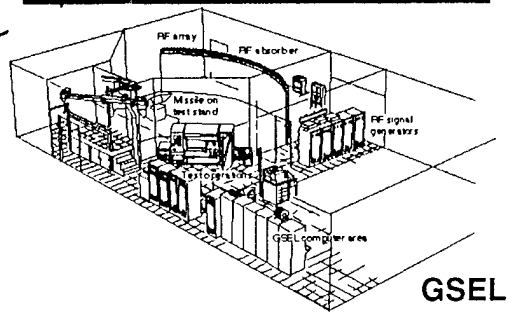


Tullahoma, TN
Air Force

Aberdeen, MD
Army

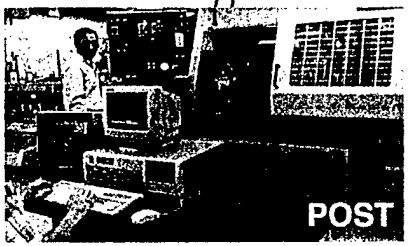
APL



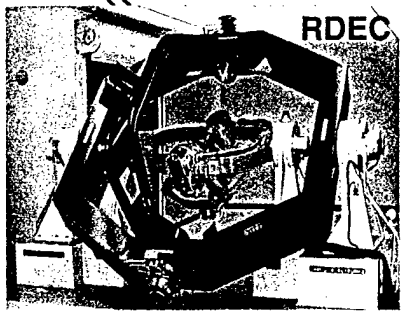


GSEL

Baltimore, MD
Navy



Tucson, AZ



Huntsville, AL
Army

This chart shows the 6 main Ranges that BMDO uses and funds

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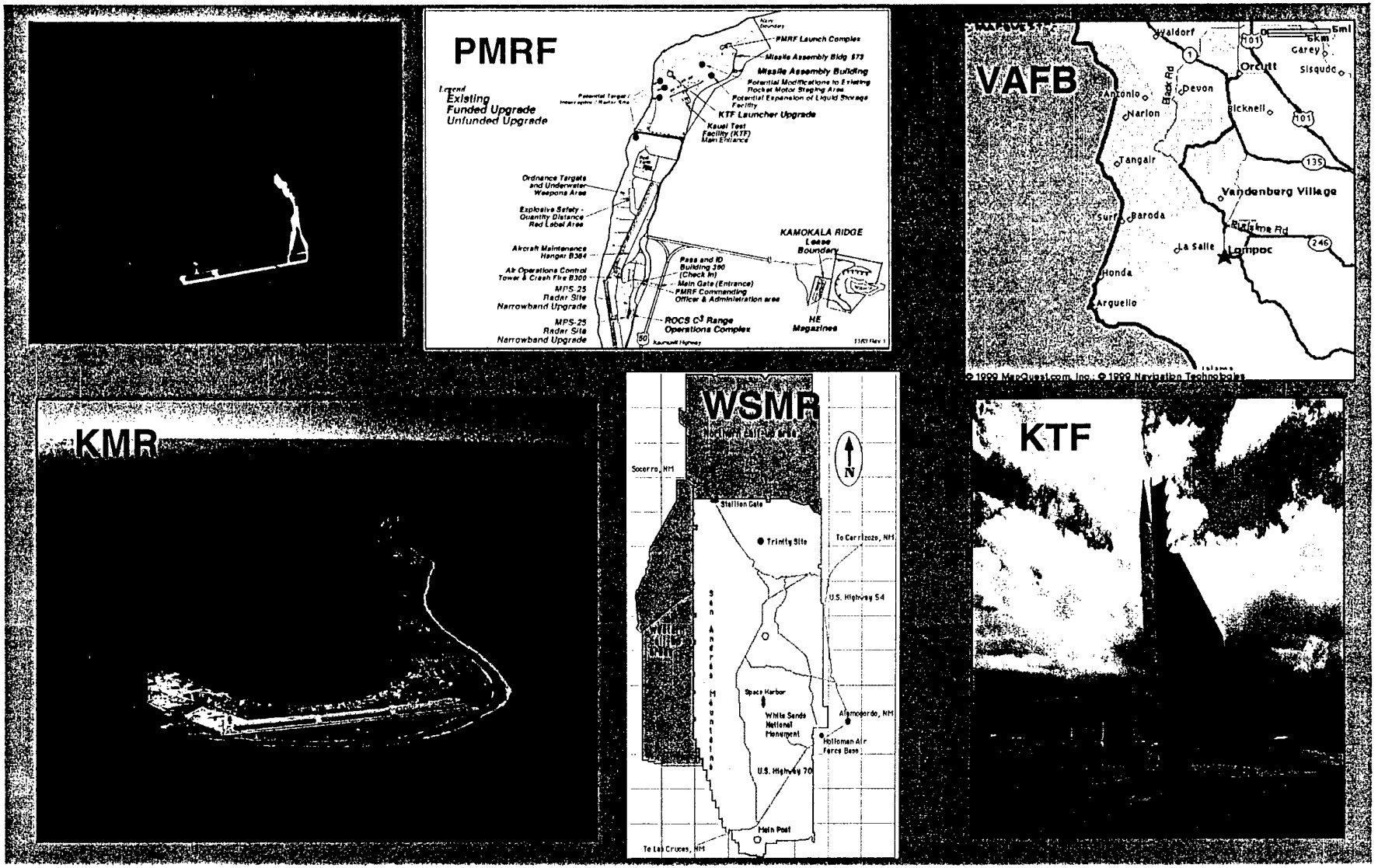
BMDO Test Ranges & Launch Facilities

BMDO/TER



This chart shows the four main BMDO funded auxiliary assets used within the BMDO test infrastructure:

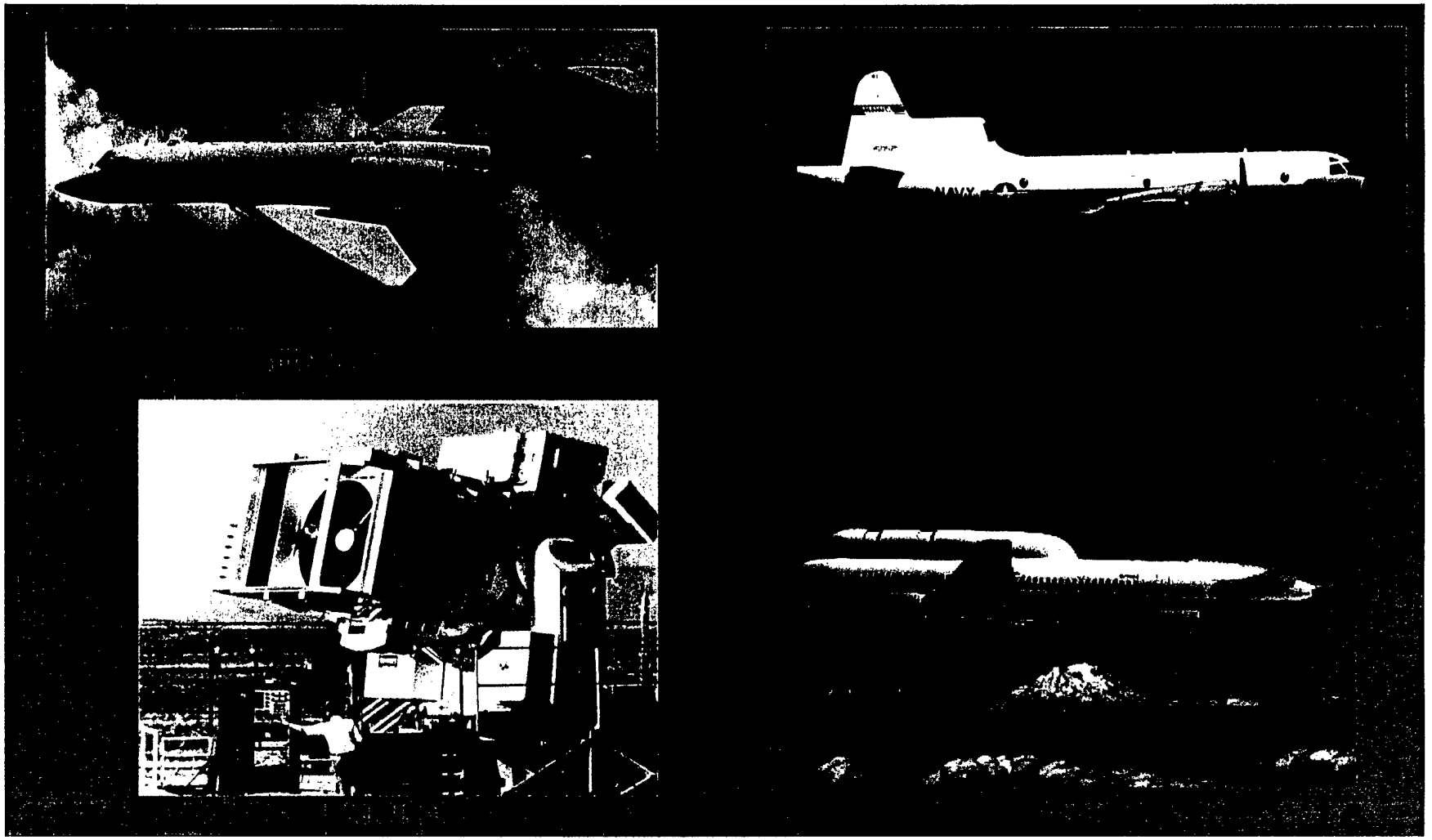
HALO, AST, NP-3, and SLBD

Halo and AST are multi-wavelength optical collection platforms that can collect data from the visible to the LWIR bands.

NP-3 is a range safety and telemetry collection platform. SLBD is an optical system used at WSMR

BMDO Auxiliary Assets

BMDO/TER



BMDO is DOD's Reliance head for all ballistic missile targets. This chart shows various targets types along the bottom and their associated range.

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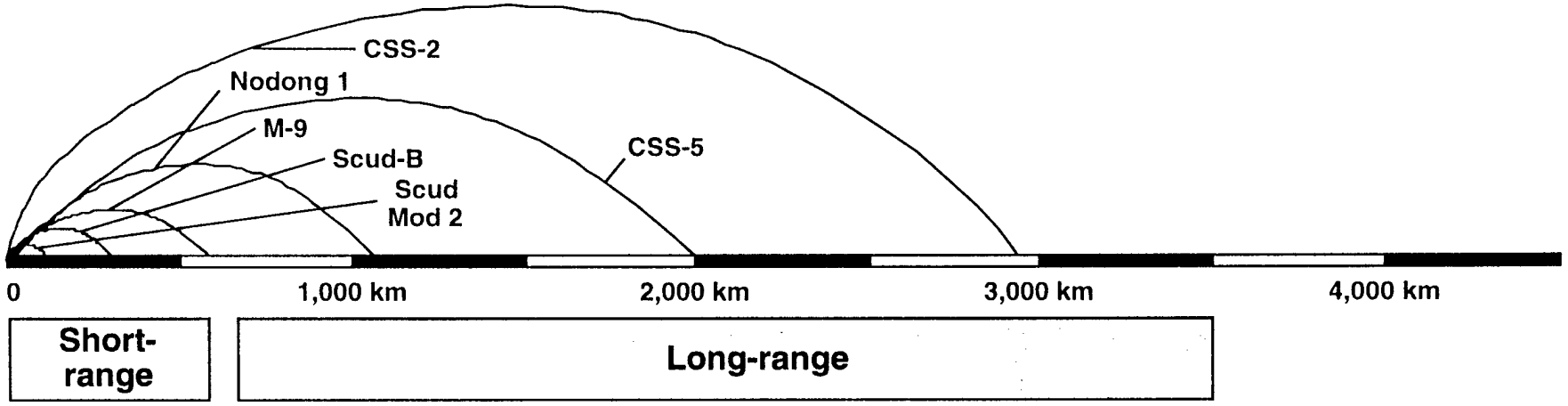
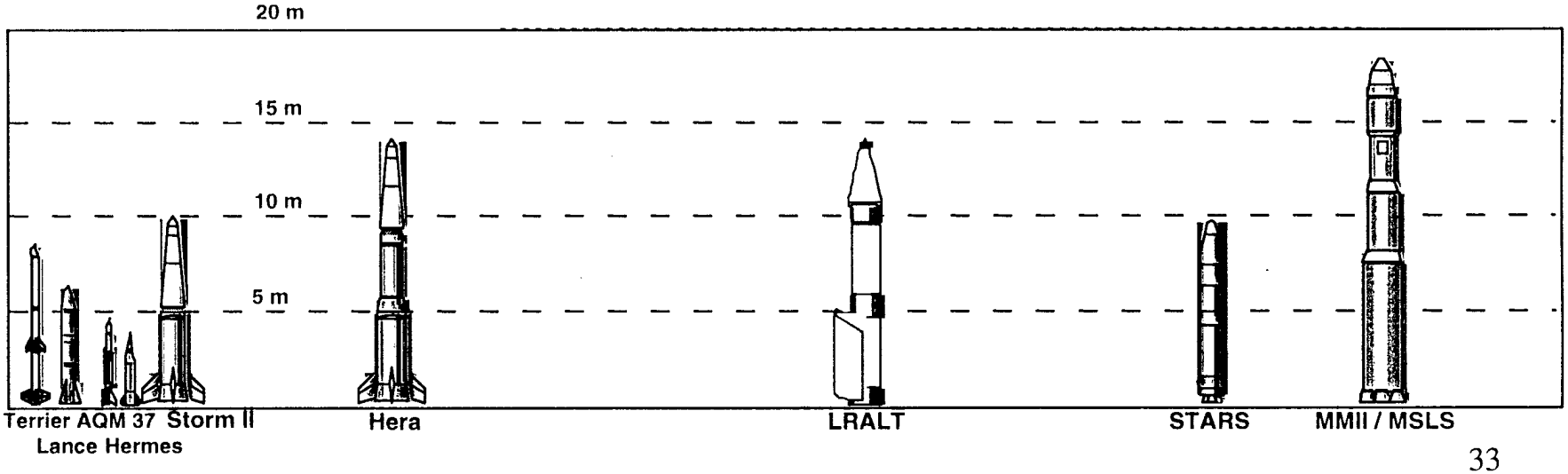
Available Target / Threat Range Comparisons

BMDO/TER





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This chart shows the targets which are currently new developments within BMDO. The mobile targets (LRALT and SRALT) will allow BMDO to test scenarios which are not tied to specific ground launch locations and launch azimuths. The liquid fueled target will be used for BPI and ABL testing

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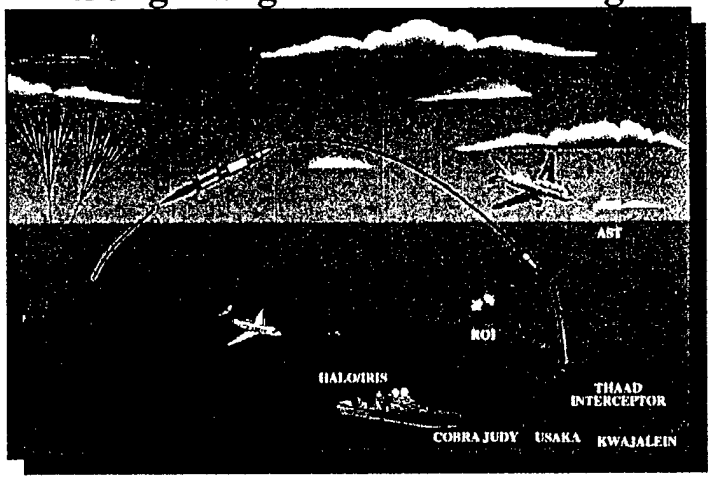
Emerging Target Requirements

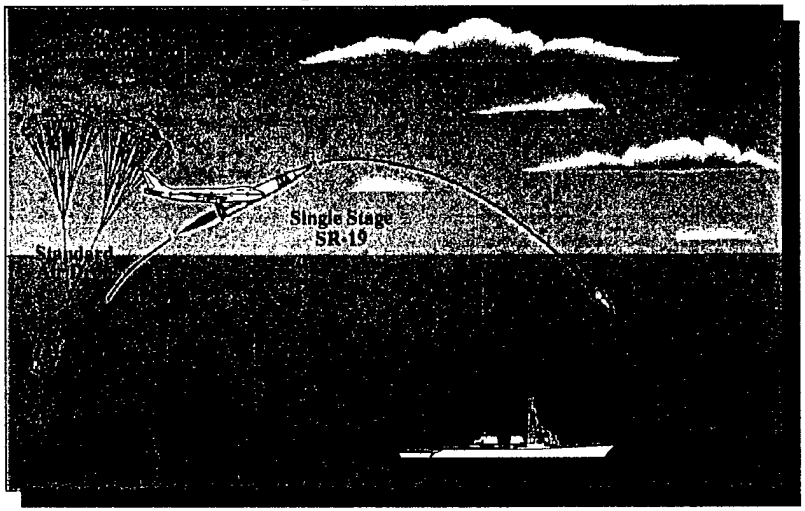
BMDO/TER

- **Short Range Air Launch Target**
  - Single Stage Threat Representative Target (SR-19)
  - Air Dropped From C-130
- **Long Range Air Launch Target**
  - 2 Stage Threat Representative Target (SR-19)
  - Air Dropped From C-17
- **Liquid Fueled Target**
  - New 3-year Target Development / Demonstration
  - Threat Representative Boost / Ascent Phase

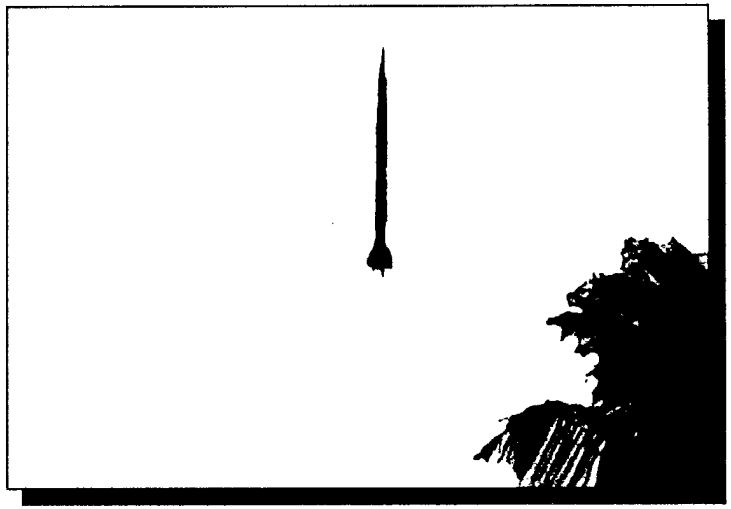
Long Range Air Launch Target



Short Range Air Launch Target



Liquid Fueled Target



This chart lists some of the key test infrastructure issues that BMDO is currently wrestling with.

BMD Test Infrastructure Issues

BMDO/TER

- **Targets**
  - Liquid Fueled Targets
  - Long Range Air-Launched Targets
  - Countermeasures
- **Ground Test Facilities**
  - ENDO Atmospheric Intercepts
  - 2&3 Color Seekers
  - Nuclear Weapons Effects Testing
  - High Velocity Impacts (+10 Mach)
- **Ranges**
  - L-Band Telemetry
  - NMD VS TMD
  - Exo-Atmospheric Intercepts
  - Debris Models
- **Ranges**
  - X-Band Radars
  - IR Data Collection & Captive Carry
- **SIL/HWIL**
  - Model fidelity
  - Hardware/Software interface
- **Environmental**
  - Environmental Assessments
  - Environmental conditions
- **Corporate Test Program**
  - FoS Testing
  - Future TCMP/SIT

In Summary, the BMDO T&E Program is structured to support the MDAP test programs, conduct FoS testing at the Corporate level, and fund a common use test infrastructure to get the biggest bang from our test bucks

Summary

- Given MDAP Needs and Interoperability Requirements, We Strive to Develop and Maintain a Tailored and Appropriate Test, Simulation, and Evaluation Strategy Which:
  - Provides Adequate Data Management and Collection Capabilities
  - Coordinates the Right Mix of Events (Flight Tests, Ground Tests, SITs, M&S, HWILTS, Etc...)
  - Assures Required Resources Are Available

Ensure each dollar spent on testing is a dollar spent for success

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PART I

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_____

Title of Paper:_Test Support to BMDO System and Technology Programs _____

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